

STUDIES ON EARLINESS IN *AVENA SATIVA*

BY

WILLIAM MAX ROSS

B.S., University of Illinois, 1948

M.S., University of Illinois, 1949

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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UNIVERSITY OF ILLINOIS, 1952

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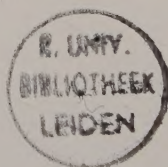
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STUDIES ON EARLINESS IN *AVENA SATIVA*

Earliness in oats and other small grains has been established as a rapid development of the plant's growth phases with an early completion of its sexual processes. It can be measured by awn emergence, coloring of the straw, or ripening of the grain. Despite the fact that the character is easily determined, little is known concerning the developmental aspects of earliness in different varieties and pure lines, and little is known about the effect on the associated morphological characters. Similarly the inheritance of the character in hybrid populations has been vague and indefinite.

The purpose of this investigation was to study the expression of the earliness phenomenon from a developmental standpoint and to observe the associated morphological characters. Information on the inheritance of earliness was also sought.

Fifteen oat varieties and lines representing three maturity groups were studied in 1950 and 1951. They were: 1) early - Illinois 30-2088, Illinois P 137, Illinois 39-47, Illinois 43-271, Fort (Illinois P 140), 60 Day, and Columbia; 2) early to mid-season - Clinton 11, Gopher, Marion, and Valor; and 3) late - Victory, Segetal, and Golden Giant.

Date of panicle initiation and date of heading were taken on each variety. Morphological data included internode number, leaf number, plant height, panicle length, and number of head-bearing culms. All data were taken on the main culms of individual plants space-planted eight inches in rows one foot apart.

Earliness of heading appears to be closely associated with panicle initiation in the plant. Panicle initiation is almost as good a measure of earliness as is the date of heading. Just as there is a range from early to late heading in the varieties studied, there is a corresponding range from early to late panicle initiation.

The vegetative period, from planting to floral initiation, is much more sensitive to environmental conditions than the reproductive period, from panicle initiation to heading. A later planting in 1951 compared with 1950 shortened the vegetative period proportionately more than the reproductive period. Temperature and length of day are probably the most important influencing environmental factors.

Rate of plant growth, time of panicle initiation, internode number, leaf number and the time of heading are all inter-related. The growth rate is approximately the same in all varieties studied while the time of panicle initiation differs considerably. With panicle initiation, leaf and internode differentiation are terminated, and elongation of the internodes and elaboration of the floral structures takes place which then leads to heading. Panicle initiation not only determines leaf and internode number but also governs the time of heading because with early panicle initiation, few leaves and few internodes are formed, and less time is required for the internodes to elongate and the panicle to emerge. The result is an early date of heading.

Of the morphological and plant characters studied, leaf and internode number seems to be the only characteristic closely associated with earliness. In both 1950 and 1951 highly significant positive correlations were found between number of internodes or leaf number and days to heading. In the late varieties the peduncle or topmost internode was significantly shorter than in the early varieties in 1951. This was attributed to greater intra-plant competition among the greater number of internodes or growth centers in the late plants.

Characters, such as height and tillering, appear to be markedly affected by environment and not correlated with time of heading. Inconsistent results were obtained both years when plant height and heads per plant were correlated with earliness.

With regard to the genetics of earliness, there is evidence

that varieties and lines may, in some cases, be composed of several biotypes which accounts, to some extent, for differences in the heading range within varieties. A great deal of heterogeneity possibly exists in a given variety that is not recognizable from phenotypic appearances alone. Only when proper conditions exist do these other genotypes express themselves.

Studies of the F_2 populations showed that earliness is a complex quantitative character and is not inherited on a simple genetic basis. Evidence was shown that earliness is dominant to lateness. F_2 populations of closely related crosses, such as 60 Day and its derivatives, were not as uniform with respect to date of heading as might be expected which indicated that different genes are involved. Wide crosses showed even more definite segregation into late and early types, giving further evidence of the complex nature of the character.

As a whole, the twenty-nine F_2 populations from seventeen crosses in 1951, as well as the twenty-two F_2 's in 1950, were too small to determine accurately or to establish the number of genes involved in the character of earliness.

VITA

The writer was born March 20, 1925 on a farm near Farmington, Illinois. He attended the city schools and in 1943 was graduated from Farmington Community High School.

After farming for a year, he entered the military Service in October 1944 and served with the Army Ground Forces in the European Theater of Operations. He was honorably discharged from the service in August 1946.

In September 1946 he matriculated at the University of Illinois and received a Bachelor of Science in Agriculture with highest honors in August 1948. He then entered the Graduate College of the University of Illinois and received a Master of Science in Agronomy in August 1949.

From September 1949 to September 1951, he held the position of Research Assistant in Plant Genetics in the Department of Agronomy at the University of Illinois. In September 1951 he was appointed Research Assistant in Agronomy at the Fort Hays Experiment Station of the Kansas State College.

